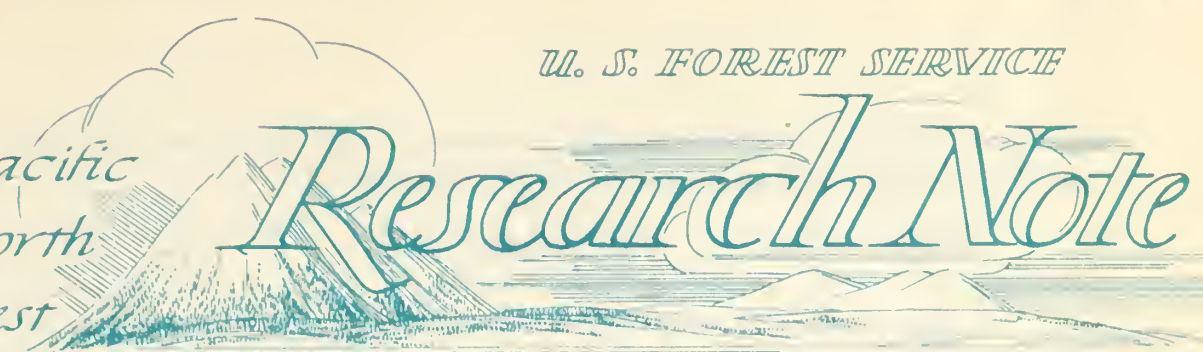


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DISPERSAL OF LODGEPOLE PINE SEED INTO CLEAR-CUT PATCHES

by

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In 1959, a study was begun to learn more about lodgepole pine (*Pinus contorta*) seed production and dissemination in south-central Oregon. This research note reports the first 4 years of record on frequency of seed crops, time of seedfall, and distance and direction of seed dispersal into clear-cut patches.

Production and dissemination of lodgepole pine seed from a timber edge are matters of very real interest in the Pacific Northwest because most lodgepole pine cones in this region open and shed their seed promptly following ripening.^{1/} Seed for natural reproduction of clear-cut areas must, therefore, come largely from surrounding timber edges. This seed supply situation contrasts sharply with that of lodgepole pine in the Rocky Mountain region where several years' production

^{1/} Critchfield, William B. Geographic variation in *Pinus contorta*. Maria Moors Cabot Found. Pub. 3, 118 pp., illus. 1957.

Mowat, Edwin L. No serotinous cones on central Oregon lodgepole pine. Jour. Forestry 58: 118-119. 1960.

Trappe, James M., and Harris, Robert W. Lodgepole pine in the Blue Mountains of northeastern Oregon. Pac. NW. Forest & Range Expt. Sta. Res. Paper 30, 22 pp., illus. 1958.

is usually held in sealed, or serotinous, cones and where unburned slash usually contains a good supply of seed.^{2/}

STUDY METHODS

Study areas consist of two recent clear cuttings on the Winema National Forest, not far from the southeast corner of Crater Lake National Park. One of the areas is 70 acres in size, the other 25. Both are surrounded by uncut lodgepole pine timber.

Seed production and dissemination are sampled by placing seed traps under the timber and at regular intervals from timber edge out into the clear cuttings.

During the first year (1959), main efforts were given to development of exploratory information on variation of seed catch among traps approximately 2 by 3 feet in size. Only 16 traps were used, but the 1959 findings provided a basis for final study design as well as a good relative measure of size of the 1959 seed crop.

Starting with the 1960 seed crop, 80 traps of the 2-by 3-foot size have been used. Traps are placed in groups of 20 according to the arrangement and relation to timber edge shown in figure 1. Each group is oriented to either an east, west, north, or south timber edge and extends into the clear cutting a distance of 462 feet at right angles to timber edge.

Seeds are collected from traps each year on about October 1 and November 1 and once again during the following summer. In 1961, however, early snow prevented the November 1 collection. Seed soundness is determined by a cutting test.

SIZE AND FREQUENCY OF SEED CROPS

Under undisturbed lodgepole pine timber, fall of sound seeds per acre ranged from a low of 14,000 for the 1961 crop to a high of

^{2/} Critchfield, footnote 1.

Tackle, David. Silvics of lodgepole pine. Intermountain Forest & Range Expt. Sta. Misc. Pub. 19, 24 pp., illus. 1959.

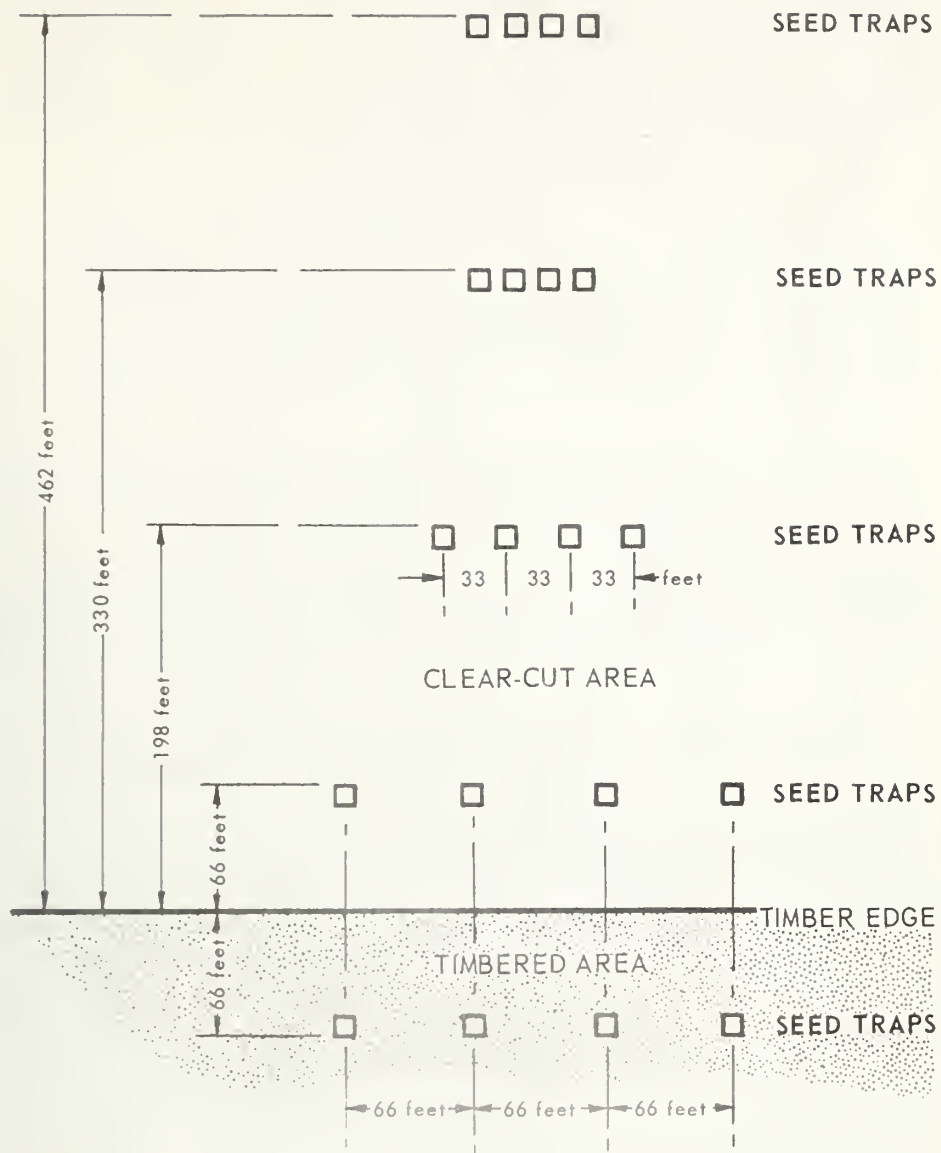


Figure 1. --Arrangement of seed traps in relation to a timber edge.

well over half a million for the 1962 crop. Total fall for 1962 is not yet known, but a cumulative count through the November 1 collection reached 572,400 sound seeds per acre. For the 1959 and 1960 crops, total catch per acre was 178,200 and 230,400 sound seeds, respectively. Thus far, moderate-to-good seed crops were produced in each of 3 years, while an almost complete failure occurred in the 4th year.

TIME OF SEEDFALL

Limited evidence suggests that the bulk of lodgepole pine seed in south-central Oregon is usually shed from cones by November 1 and in some cases may be mostly shed by early October. Thus in 1960, 75 percent of the seed had fallen by October 4 and 97 percent by October 31. Similarly in 1961, 88 percent of the seed was shed by October 9.

Seedfall occurred somewhat later during the other 2 years. In 1959 only 39 percent of the seed had fallen by October 4, and in 1962 not more than 8 percent had been released by October 3. However, 89 percent of the 1959 crop had been shed by November 3; but observations not yet complete may possibly reveal that a sizeable proportion of the 1962 crop was shed after November 1, the last seed collection date.

DISTANCE AND DIRECTION OF SEED DISPERSAL

Number of seeds dispersed into clear cuttings decreased sharply within the first 66 feet from timber edge and then diminished more gradually out to 462 feet, the maximum distance studied (fig. 2). This finding was consistent for timber edges on all sides of clear cuttings (north, south, east, and west) and for all 3 years in which seed dispersal was studied. In terms of average annual seedfall for the 1960-62 period, number of seeds decreased from 272,300 per acre within the timber to 17,200 seeds at 66 feet from timber edge, to 2,450 seeds at 198 feet, and to only 540 seeds at a distance of 462 feet.

Although pattern of dispersal was similar for all timber edges, the most seeds were dispersed along the west boundary of the clear cutting and the fewest along the south boundary (fig. 2). These differences were significant^{3/} for the 1962 seed crop and also for the

^{3/} Chi square test at odds of 99 out of 100.

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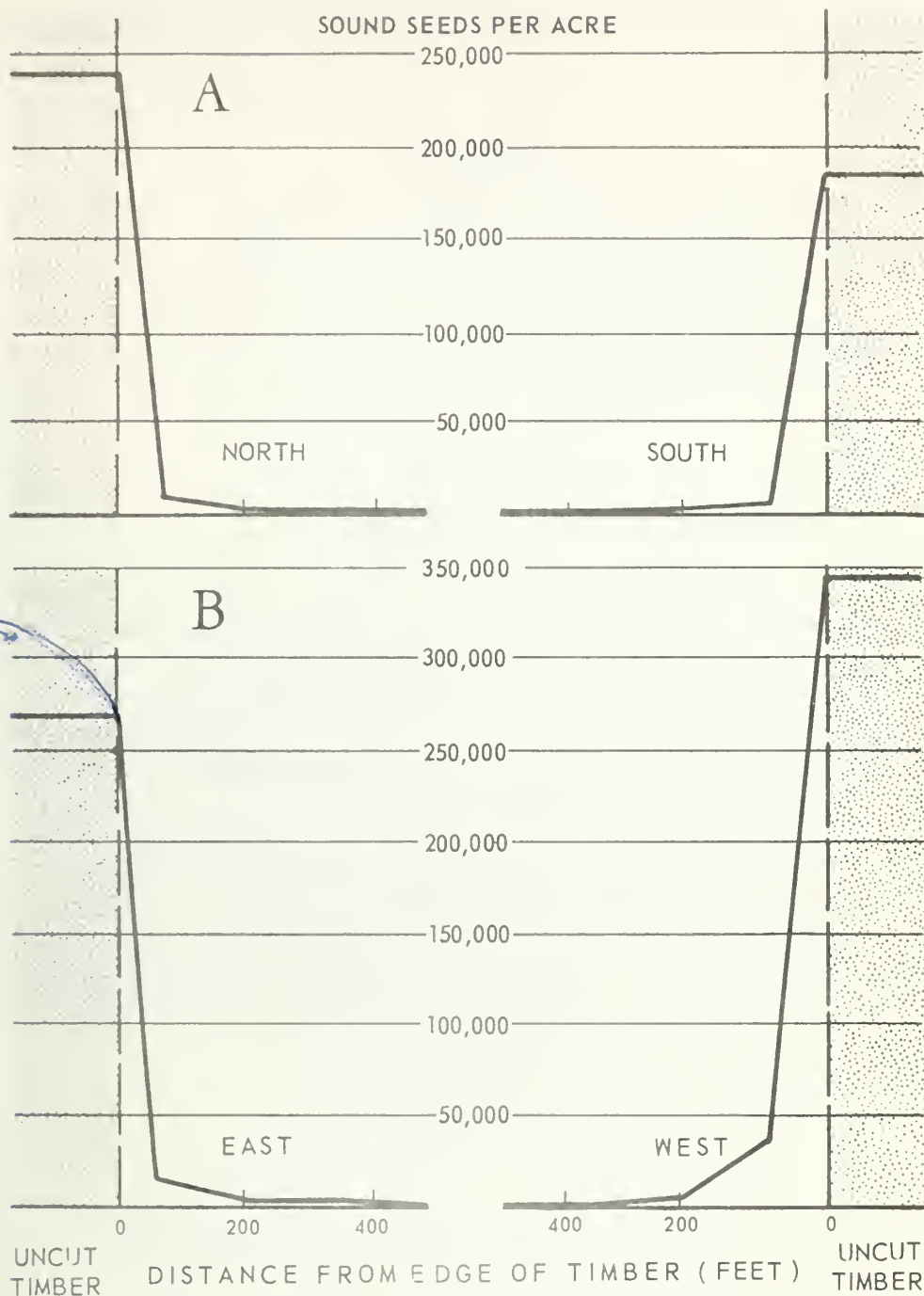


Figure 2.--Average annual seed catch for the period 1960-62, inclusive, by distance and direction from trap to seed source. A, North and south timber edges; B, east and west timber edges.

average seed crop produced over the 3-year period 1960-62. Differences among timber edges were nonsignificant for the 1960 seed crop, however, and the 1961 seed crop was too small to provide data for a meaningful analysis.

DISCUSSION

Periodicity and volume of seed crops cannot be fully evaluated in a period as short as 4 years. However, evidence from the present study on frequency of seed crops agrees closely with Mowat's^{4/} conclusion for lodgepole pine in central Oregon: "Many trees bore persistent cones in such numbers as to indicate a crop nearly every year, but with occasional years of scarcity." Thus, we can be fairly confident that the present estimate of three seed crops in 4 years is reasonable.

The only seed production data available for comparison comes from the Rocky Mountain Region. Boe^{5/} reported an average of 17,500 seeds per acre annually from a 4-year study in Montana. Bates^{6/} reported an average annual per-acre production of 72,922 seeds from a 10-year Wyoming study and 320,053 seeds from a concurrent 10-year Colorado study. The great range among these widely scattered locations leads to a tentative conclusion that lodgepole pine seed production varies greatly not only from year to year but also with site factors and age and density of stand.

Findings from the south-central Oregon study on pattern of seed dispersal from a timber edge are very similar to those reported by other investigators. Boe,^{7/} for example, reported that number of seeds dispersed into a clear-cut area from surrounding timber fell off sharply at a distance of 66 feet. He concluded further that

^{4/} See footnote 1.

^{5/} Boe, Kenneth N. Regeneration and slash disposal in lodgepole pine clear cuttings. Northwest Sci. 30: 1-11, illus. 1956.

^{6/} Bates, C. G. The production, extraction, and germination of lodgepole pine seed. U.S. Dept. Agr. Tech. Bul. 191, 92 pp., illus. 1930.

^{7/} See footnote 5.

number of seeds disseminated more than 198 feet "is inadequate and undependable for reproducing a stand." Munger's observations of old burns in central Oregon led to similar conclusions.^{8/} He reported that a full stand of reproduction usually extended about 200 feet from seed source and a fair number of seedlings extended another 500 feet

CONCLUSIONS

In south-central Oregon, good crops of lodgepole pine seed are produced in most years. Because seeds in this general area are not stored in serotinous cones, however, natural regeneration of clear cuttings depends largely upon seeds dispersed from surrounding timber. Number of seeds dispersed into clear cuttings falls off very rapidly as distance from a timber border increases and reaches a very low level at distances beyond 200 feet. Consequently, foresters should restrict the width of clear-cut strips, patches, or blocks to about 400 feet if they plan to provide an ample seed supply for prompt natural regeneration.

The south-central Oregon study provides considerable evidence that most of the current year's crop of seed is shed by November 1 and in some cases by early October. Seed-catch records also indicate that seed dispersal from a western timber edge of a clear cutting is above average, while that from a southern timber edge is below average. Additional years of record will be needed to confirm or disprove both of these hypotheses

^{8/} Munger, Thornton T. The encroachment of lodgepole pine on western yellow pine on the east slopes of the Cascade Mountains in Oregon. U. S. Dept. Agr., Forest Service. (Typed manuscript on file at Bend Silviculture Laboratory.) 1908.

